Perception of Music-Emotion in Veterans with Post-Traumatic Stress Disorder

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PERCEPTION OF MUSIC-EMOTION IN VETERANS WITH POST-TRAUMATIC STRESS DISORDER

By

Evan Joseph Privoznik

A THESIS

Submitted to the Faculty of the University of Miami in partial fulfillment of the requirements for the degree of Master of Music

Coral Gables, Florida

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A thesis submitted in partial fulfillment of the requirements for the degree of Master of Music

PERCEPTION OF MUSIC-EMOTION IN VETERANS WITH POST-TRAUMATIC STRESS DISORDER

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The purpose of this study was to determine whether veterans with post-traumatic stress disorder (PTSD) perceive emotions in music differently than veterans without PTSD. Thirty-five veterans participated in this study, 18 with PTSD and 17 without PTSD. Each participant took part in one 45-minute music listening task to identify the type of emotion and emotion intensity of 25 musical excerpts. Excerpts were selected from a previous study and came from film scores. A measure of state mood was used to control for mood effects on music-emotion perception. Music-emotion categorization was analyzed by chi-square tests. A between-subjects analysis of covariance (ANCOVA) was completed to determine any main effects or interactions amongst the perception of music-emotion category and intensity between veterans with PTSD and veterans without PTSD, while controlling for the effect of mood.

Results indicated that no statistically significant difference existed between veterans with and without PTSD in how they categorized music-emotions (all p>.137). Results also showed no statistically significant main effect of music-emotion intensity ($F_{(2.97,80.21)} =5.10, \ p=.674$). Finally, no statistically significant interactions were found, however, the interaction between music-emotion intensity and category had a medium effect size (Partial $\eta^2=.091$). The results gathered from the study elucidate the differences in perception between veterans with PTSD and veterans without PTSD. The
results will then determine whether or not music is an appropriate stimulus for veterans with PTSD.
DEDICATION

I am honored to dedicate this paper to the two veterans in my life, my grandfathers, Lloyd Gaylord and Louis Privoznik. To all veterans, thank you for your service, your courage, and your sacrifice.
Acknowledgment

First and foremost, I would like to thank God for giving me strength, knowledge, and wisdom throughout my life. “I can do all things through Christ who strengthens me.” (Philippians 4:13)

I would like to thank Dr. Teresa Lesiuk, my advisor, for guiding me through this thesis. Thank you for your time, energy, ideas, and your endless support. Thank you to Dr. Shannon de l'Etoile and Dr. Jennifer Britton, my other two committee members, for your knowledge and passion. I would also like to give special thanks to Shawn Buller for her tireless efforts at the VA hospital. This study would not have been possible without you.

Ever since I was young, my parents encouraged me to make music a part of my life. They gave me the opportunity to play any instrument I wanted, listened to me practice those instruments (without earplugs), attended all of my concerts, and then sent me thousands of miles away to pursue my dreams. Thank you, mom and dad, for always loving me, praying for me, supporting me, and believing in me. To the rest of my family, thank you for your thoughts, your prayers, and your encouragement. To my friends, thank you for giving me a reason to smile, even during the toughest times.

Finally, to my wife Sarah, thank you for being my cheerleader, my editor, my gourmet chef, my coach, my support, my love, and my life. I would be lost without you.
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CHAPTER 1
INTRODUCTION

Statement of the Problem

Post-traumatic stress disorder (PTSD) is a trauma and stressor-related disorder that is caused by an extreme trauma (American Psychiatric Association [APA], 2013). A PTSD diagnosis may be given after an individual experiences a traumatic event. Trauma is the direct personal experience of an event that involves experiencing, witnessing, or learning about actual or threatened death, or serious injury. The response to this event must involve intense fear, helplessness, or horror. Traumatic events include military combat, assault, a disaster, or an accident. Consideration for a PTSD diagnosis only occurs if symptoms last longer than three months, cause great distress, and disrupt work and home life. These symptoms include intrusive memories, avoidance of public places, emotional numbness, hyperarousal, anxiety, and increased emotional arousal (Rodriguez, Holowks, & Marx, 2012). Individuals who experience PTSD tend to relive traumatic events through nightmares or flashbacks and tend to avoid trauma-related thoughts, feelings, and reminders. A sight, sound, or smell can trigger recall of a traumatic event, which leads individuals with PTSD to avoid certain situations like being in a crowd, driving, going to a movie, or being alone (APA, 2013). Due to these symptoms, individuals with PTSD tend to experience significant distress or impairment in daily functioning, such as avoidance and numbing in relationships, parenting difficulties, negative work or academic performance, and financial problems or homelessness. Even though symptoms may occur immediately, they must be present for six or months before a psychiatrist may make a PTSD (Rodriguez, Holowks, & Marx, 2012).

The lifetime prevalence of PTSD among adult Americans is 6.8%, with occurrence in women (10.4%) more than twice as prevalent as in men (5%) (National Comorbidity Survey Replication, 2005). For those who serve in the military, the
prevalence of PTSD is even greater (Hermes, Rosenheck, Desai, & Fontana, 2012). Researchers in the 1980s estimated that veterans from the Vietnam War had a 15.2% and 8.1% prevalence of PTSD for males and females respectively (Kulka et al., 1990). A decade later, researchers estimated that veterans from the Gulf War had a 10.1% prevalence of PTSD (Kang, Natelson, Mahan, Lee, & Murphy, 2003). Recently, researchers estimated that veterans from Operation Enduring Freedom/Operation Iraqi Freedom had a 13.8% prevalence of PTSD (Tanielian & Jaycox, 2008).

**Post-Traumatic Stress Disorder and Emotional Processing.** Since much of the criteria for a PTSD diagnosis are related to feelings and emotions, emotional processing abilities in veterans with PTSD require thorough understanding. The emotional deficits associated with PTSD, however, are not well understood (Litz, Orsillo, Kaloupek, & Weathers, 2000). Researchers interviewed combat veterans to investigate whether veterans with PTSD withhold or conceal emotions to regulate their arousal and dampen their feelings (Litz, Orsillo, Roemer, & Wagner, 2001). They found that combat veterans with PTSD reported significantly more frequent and intense withholding of their emotional responses than did veterans without PTSD. Emotional concealment needs further research to determine if veterans with PTSD use it to regulate and dampen emotions. The researchers concluded that veterans with PTSD may benefit from learning effective emotion regulation skills.

Emotion regulation is the way in which individuals respond to their emotions, and can be difficult for adults with PTSD. Adults with PTSD struggle with emotion regulation, lower awareness of emotions, a greater tendency to avoid emotions, and a greater likelihood of responding to emotions with fear and shame, for example (Tull, Barrett, McMillan, & Roemer, 2007). Many different negative emotions can be experienced throughout the course of the disorder, including sadness, anger, guilt, shame, anxiety, and fear. As all of these emotions may either occur in close proximity to one another or
simultaneously, they can be difficult to identify. Emotions that are difficult to identify can become out of control and difficult to manage. Individuals with PTSD often manage emotions in unhealthy ways, such as self-medication with drugs or alcohol, or avoidance of the emotions or situations that cause these emotions. Overall, individuals who have PTSD symptoms often have difficulty controlling or make sense of their internal experiences and have difficulty talking about the trauma (Behrens, 2010).

Wolf, Miller, and McKinney (2009) investigated numbing and heightened negative emotionality in male veterans with and without PTSD. The participants rated their emotional responses to pleasant and unpleasant photos taken from the International Affective Picture System (Lang, Bradley, & Cuthbert, 2005) as well as photos depicting scenes of Vietnam War combat. The researchers provided two hypotheses for this study. The first hypothesis stated that veterans with PTSD experience a general numbing of emotions, as evidenced by lower mean arousal and/or valence ratings for both pleasant and unpleasant photos. Alternatively, the second hypothesis stated that veterans with PTSD experience a hypo-activation of only positive emotions, evidenced by lower mean arousal and/or valence ratings for only pleasant photos. The researchers also hypothesized that if veterans displayed an overall enhancement of negative responses to unpleasant stimuli, greater ratings of arousal and lower ratings of valence would be evident across all pictures as compared to veterans without PTSD. If the veterans with PTSD only experienced enhanced negative responses to trauma-related stimuli, negative ratings would be exaggerated in response only to trauma-related stimuli.

The results showed that veterans with PTSD reported significantly greater negative emotions in response to all unpleasant photographs compared to veterans without PTSD. Veterans with PTSD also showed a significantly greater negative emotional response to trauma-related images than to the pleasant and unpleasant
images. Responses to the pleasant images, however, were similar between the treatment and the control group. These findings were not associated with differences in combat exposure, experiences, or depression, which suggests that the emotional processing abnormality is specific only to the veterans with PTSD.

Recent neuro-imaging studies help explain the effect of trauma experiences on emotional processing. Adults with acute PTSD took part in an emotion recognition task while undergoing functional magnetic resonance imaging (fMRI) to investigate their amygdala response; an area of the brain known for emotion processing (Armony, Corbo, Clement, & Brunet, 2005). Participants viewed pictures of faces that depicted an emotional facial expression, either happy or fearful, and a neutral facial expression. The presentation of the pictures occurred in sets, with the first picture displayed for a brief period of time and the second picture displayed for a longer period of time. This specific presentation of pictures produces a masking effect, where the participants fail to consciously perceive the first picture. In half the trials, the first picture was of an emotional face, while the second was a neutral face. In the other half of the trials, researchers switched the pictures’ order. The results showed that the amygdalae of participants with high PTSD symptoms showed stronger activation while viewing fearful facial expressions during the short presentation and happy facial expressions during the long presentation. These findings suggest that abnormalities in amygdala function are apparent in the acute phase of PTSD.

Abnormal emotional processing in veterans with PTSD is also reflected in the brain reward system. The effect of PTSD on the brain reward system was examined using fMRI during a validated passive-viewing monetary reward task (Elman et al., 2009). Participants included individuals with chronic PTSD and individuals without PTSD. Researchers hypothesized that PTSD would be associated with decreased activity in the reward-related brain regions. Each participant was given $50 and told that
three different spinners would be spun: a “good” spinner that generated gain, a “bad”
spinner that generated loss, and an “intermediate” spinner that could generate both gain
and loss, in varying amounts. Unbeknownst to the participants, the trial sequence was
identical for all subjects and programmed to a final net winning of $78.50. After the trial,
participants estimated their overall monetary gain or loss. During the trial, fMRI scans
were conducted to determine differences in brain function during gains and losses in
participants with PTSD compared to normally functioning participants.

Results showed that participants with PTSD showed significantly smaller bilateral
striatal activations in brain reward function during the task than participants without
PTSD. Scans obtained from typically-functioning participants were consistent with prior
observations of the same population. This finding suggests that participants with PTSD
can be unmoved by rewards as well as punishments. The data support the hypothesis
that PTSD is associated with abnormal processing in brain reward regions. These
findings also support the idea that individuals with PTSD may report less intensity of
positive emotions.

The previous studies show that individuals with PTSD experience deficits in
emotional intelligence, ranging from poor emotion regulation skills to abnormal
perceptions of emotion intensity. Conversely, low emotional intelligence may predict
post-traumatic stress (Tarasuik, Ciorciari, & Stough, 2009). In order to appropriately
cope with the disorder, individuals with PTSD must learn to accurately perceive and
differentiate sensations and emotions. Music is an effective medium for the perception
and differentiation of emotion, but only if the listener can accurately perceive emotion
communication through music.

Emotions can be perceived in music (Bhatara, Tirovolas, Duan, Levy, and
Levitin, 2011; Coutinho & Cangelosi, 2011; Fritz, et al., 2009; Juslin & Laukka, 2003),
but certain disorders may affect that ability. Music-emotions are defined as emotions that
are recognized or perceived in music through features such as harmony, timbre, and lyrics (Kim et al., 2010). Whether individuals with PTSD are able to perceive music-emotions similarly to typical adults is unknown, however, research findings report that individuals with PTSD have difficulty with general emotional regulation and perception. This author hypothesizes that veterans with PTSD will be able to identify positive emotions the same as veterans without PTSD, but will rate negative music-emotions more intensely than veterans without PTSD. In order to further understand post-traumatic stress disorder, deficits in emotional processing, and ability to perceive emotions in music, previous studies and other related literature are reviewed.

Need for the Study

**Theoretical Relevance.** Currently, research exists that explores the difficulties with emotional processing in veterans with PTSD, yet little research exists that addresses their abilities to correctly identify emotions. If a veteran with PTSD experiences greater difficulty with this task than a veteran without PTSD, it could be a major contributing factor to the difficulties they experience with emotional processing. Another area in need of investigation is the music perception abilities of veterans with PTSD. Any significant differences between the way in which veterans with and without PTSD perceive music could have implications for music therapy treatment and therefore warrants further research.

**Clinical Relevance.** Research into the use of music therapy with veterans with PTSD is limited. The research available focuses mainly on the efficacy of music therapy, but does not address the underlying mechanism of the effect (Carr et al., 2011). Through music therapy, veterans with PTSD may have the opportunity to use music to process emotions related to their time in the service and, more specifically, their trauma. In order to complete this task, participants must be able to correctly identify the emotion of the music so they can in turn identify their own feelings. Once veterans with PTSD are
aware of their feelings, emotional processing may begin. Veterans with PTSD can practice identifying emotions through perceiving emotions in music.

This study will help to determine if veterans with PTSD perceive emotion in music differently than veterans without PTSD through the use of a music listening task. The results gathered from the study will elucidate any differences in perception between veterans with PTSD and veterans without PTSD. The results will then determine whether or not music is an appropriate stimulus for emotion identification for veterans with PTSD.

**Purpose Statement**

The purpose of this study is to determine whether adults with post-traumatic stress disorder (PTSD) perceive emotions in music differently than veterans without PTSD. Specifically, the study will examine how individuals with and without PTSD perceive type and intensity of emotion in several musical excerpts.
CHAPTER 2
REVIEW OF RELATED LITERATURE

This chapter will review research literature pertaining to music listening, emotion, and how both typical and special populations perceive emotions in music. The first section of this chapter will outline the neural structures that are active while listening to music. In the second section of this chapter, emotion is defined and the neural structures activated in relation to emotion are identified. The types of emotions most often perceived in music and the way in which listeners perceive those music-emotions are also listed in this section. The final section of this chapter explores the implications this study has for future studies.

Music Listening and Neural Activation. This section of the chapter outlines the brain structures activated during music listening. Researchers outlined the cognitive modular functions underlying music perception, thus providing a framework for music processing (Koelsch & Siebel, 2005). In the early processing stages of acoustic information, sound enters the ear and hearing mechanism and electrochemical energy begins in the cochlea. The transformation continues in the brainstem where the superior olivary complex and the inferior colliculus respond to pitch, timbre, intensity, as well as other sound properties. Further, at this stage of auditory processing, “danger” signals are identified by the superior colliculus and thalamus. The auditory information then transfers to the primary auditory cortex as well as the amygdala and the medial orbitofrontal cortex. In the primary auditory cortex, the identification of acoustic features such as pitch height, intensity, and roughness occurs, while the amygdala and medial orbitofrontal cortex assign meaning and emotion to the auditory information. Following the identification of auditory features, the auditory information continues on to several other modules, including auditory sensory memory, gestalt formation, structure building, and action. For the purpose of this study, the module concerned with emotion and meaning
is particularly salient. With the model presented by the researchers, further research can be completed in the area of emotion and music.

To examine brain activation during passive music listening, researchers performed PET scans on typical adults listening to unfamiliar instrumental music (Brown, Martinez, & Parsons, 2004). Researchers selected music specifically to elicit strongly pleasant feelings, though this was not made known to the participants. Areas of the brain known to respond to music, such as the primary auditory, secondary auditory, and temporal polar areas, were active. PET scans showed additional activation in the subcallosal cingulate gyrus, the prefrontal anterior cingulate, the retrosplenial cortex, the hippocampus, the anterior insula, and the nucleus accumbens; these areas are associated with the limbic and paralimbic areas of the brain. These findings suggest that unfamiliar and familiar music activates similar neural structures in the limbic system.

Participants listened to music while undergoing an fMRI scan in order to determine whether music that depicts several different emotions activates different neural areas (Mitterschiffthaler, Fu, Dalton, Andrew, & Williams, 2007). To establish music selections for the task, participants listened to and rated instrumental music pieces based on their emotional response to the music. The researchers found that, out of the 60 pieces played, 20 accurately induced the intended music-emotion. Of the 20 songs, five were considered happy, five sad, and ten were neutral-emotion pieces.

The researchers then utilized fMRI to identify brain structure activation in response to the 20 musical pieces from the first study. During the presentation of the “happy” music, the ventral and dorsal striatum, anterior cingulate, parahippocampal gyrus, and auditory association areas were activated (Mitterschiffthaler, Fu, Dalton, Andrew, & Williams, 2007). The hippocampus, amygdala, and auditory association areas were activated during the presentation of the “sad” music. The “neutral” music produced activation in the insula and auditory association areas. The researchers’ findings suggest
an emotion processing network that responds to music, which they simply refer to as a reward system. This system integrates the ventral and dorsal striatum, areas involved in reward experience; the anterior cingulate, an area involved in targeting attention; and the medial temporal areas, areas found in the appraisal and processing of emotions.

The preceding studies explored the structures of the brain that are active while listening to music with affective content. Findings identified neural structures that belong to the brain reward system, including the amygdala and the hippocampus, as well as auditory association areas and the prefrontal cortex. Researchers from one study postulated the existence of an emotion processing network that responds specifically to music (Mitterschiffthaler, Fu, Dalton, Andrew, & Williams, 2007). Understanding the perception of music-emotion involves not only the identification of the active neural structures of music listening, but those of emotion perception as well. In the following section, emotion is defined and the neural structures active during emotion perception are identified.

**Emotion Defined.** Emotion has no single agreed-upon definition in the literature (Cabanac, 2002), but is defined by the Oxford Dictionary (2013) as a natural instinctive state of mind deriving from one’s circumstances, mood, or relationships with others. It is difficult, however, to define emotion without listing types of emotions, such as happiness, sadness, anger, and so forth. Cabanac (2002) proposes that an emotion is a mental experience made up of four dimensions, which consist of duration, quality, intensity, and hedonic process. Duration refers to the length of the emotion, while quality refers to the label given to the emotion (e.g., happy, sad, etc.). Intensity is the magnitude of the emotion’s stimulus, and hedonic value is the pleasantness of the emotion. All four dimensions exist separately from each other, but influence one another as well.

Scherer (2005) discusses the problem of defining emotion, as well as how to measure it. Scherer lists several of the dimensions previously described by Cabanc, and
defines the systems of the brain and the elements of emotion that they control. The central nervous system controls information processing, system regulation, executive actions, and monitoring of internal state. The neuro-endocrine and autonomic nervous system controls system regulation; the somatic nervous system controls communication and action. Together, these systems generate emotion perception.

Juslin and Sloboda (2001) formulated three different ways to conceptualize emotion including the categorical approach, the dimensional approach, and the prototype approach. Under the categorical approach, emotions are categorized into mood classes, which implies a limited number of basic emotions under which all other emotions fall. One of the critiques of this approach is a lack of a universally-accepted set of basic emotions. According to the dimensional approach, emotions are identified based on their placement in a number of dimensions, such as valence, activity, and potency. The circumplex model is a widely-used dimensional model which uses valence and activation as its two dimensions (Russell, 1980). Emotions are categorized into either pleasant or unpleasant as part of the valence dimension, and high arousal or low arousal for the activation dimension. This model is a simple yet effective way of emotion organization, but does not differentiate between emotion types. For example, sadness and boredom are highly correlated with one another due to their level of unpleasantness and low arousal, but are two completely different emotions. Finally, the prototype approach addresses both the content of individual categories and the hierarchical relationships among categories. The prototype has a two-dimensional graphic structure: with the vertical axis indicating the hierarchical relationship among categories, and the horizontal axis displaying the relationships among members of the same prototype category. Three levels exist on the vertical axis: the superordinate level, the prototypes level, and the subordinate level. The superordinate level is the most general level, where emotions are defined by positive or negative valence. The prototypes level represents
the basic emotions, while the subordinate level consists of emotions which relate to
those basic emotions. While this approach combines both the categorical and
dimensional approaches, there are disagreements about which emotions are basic and
whether emotions have boundaries that can clearly separate them from other emotions.

Each emotional approach possesses both positive and negative factors, but, for
this study, only aspects of the categorical and dimensional approaches are considered.
In the next section, emotion is examined through observation of the brain structures
activated during emotional processing.

**Emotion and Neural Activation.** Processing of emotion occurs in several neural
structures including the hippocampal formation, the amygdala, the ventral tegmental
area, the ventral striatum, and the basal ganglia (Schacter, Gilber, & Wegner, 2012).
Together, these structures form the limbic system. The limbic system controls emotions,
memory, reward, and, in large part, determines unique personality. Unlike other
systems, the circuitry for reward, emotion, and memory are highly integrated and often
depend on each other (Martin, 2012). There are singular neural structures, however, that
are more active for each of these functions. Of the structures listed, the amygdala plays
the largest role in emotional processing.

The amygdala is divided into three principal nuclear groups: the basolateral, the
cortical, and the central nuclei (Martin, 2012). The basolateral nuclei are responsible for
attaching emotional significance to a stimulus, often through sensory information. This
information is then projected to the central nuclei, the part of the amygdala that mediates
emotional responses. The central nuclei project to the autonomic nervous system where
physiological responses are either activated or inhibited (Levenson, 2014). Similar to the
basolateral nuclei, the cortical nuclei receive sensory information, specifically from the
olfactory bulb, and are used for perception and sexual responses. As a whole, the
amygdala is responsible for labeling a stimulus with a specific emotion and then
activating systems that determine how to respond to the stimulus based on that emotion. The perception of emotion and labeling of a stimulus, such as music, will be discussed in the following section.

**Perception of Music-Emotion.** Psychoacoustic features such as volume, timbre, and tempo help listeners perceive emotions in music (Coutinho & Cangelosi, 2011). A previous study by Coutinho and Cangelosi outlined a model that predicted musical emotions. In this study, researchers identified six psychoacoustic features of music that aid in predicting which emotions individuals will perceive or feel while listening to the music (Coutinho & Cangelosi, 2010). Using the information gained from the model, the researchers conducted a follow up study where participants listened to music chosen to illustrate a wide range of emotions. Participants rated their arousal and valence on a scale from high to low when listening to the music for each selection.

Researchers found that the emotions expected to be perceived and induced corresponded significantly to the emotions the listeners reported. All pieces tended to increase arousal and positive valence, while negative valence was infrequently reported. Some participants reported finding difficulty rating the music at a negative valence level due to an experience of positive sensations with all pieces. With respect to psychoacoustic features, researchers found significant positive relationships between loudness, tempo, timbre, and arousal. Pitch level also significantly related with both arousal and valence in a positive direction. The relationship between pitch level and arousal and valence suggests a complex association between different types of emotions since pitch may affect arousal and valence together, separately, or not at all.

The same researchers also analyzed temporal and spatial interactions between sound features and emotional ratings (Coutinho & Cangelosi, 2011). These results showed that a human emotional experience with music can be accurately predicted
based on the psychoacoustic features of the music. These features are not found only in music, but in the general auditory domain as well.

In another study exploring the psychophysical properties of music, researchers examined the psychophysical relationship between musical tempo and perceived activity (Holbrook & Anand, 1990). The researchers also investigated the impact of musical tempo on the listener's affect and the influence of context on the natural rate and preferred pace that maximizes hedonic response. Participants listened to 14 musical stimuli that differed only in tempo. A low-arousal group sat still with their eyes closed between stimulus presentations, while a high-arousal group spent the time working on anagram puzzles. Participants listened to and rated perceived activity and affect of a set of musical stimuli. The results showed a strong positive relationship between perceived activity and musical tempo. Affective responses reached their peak at an intermediate level of musical tempo, and an increase in situational arousal led to an increase in preference for faster tempo. Psychophysical properties aid in identification of emotions in music even when the music is not familiar to the culture.

To further explore the relationship between culture and discernment of music emotion, researchers used Western music to determine if the perception of three basic emotions (happy, sad, scared/fearful) in music is universal or developed by culture (Fritz, et al., 2009). Participants from a native African population, Mafai, and a Western population listened to computer-generated piano pieces specifically designed to express happy, sad, and fearful emotions. After listening to a piano piece, participants identified the emotion they perceived. The individual chose one of three pictures of faces which depicted emotional expressions, each corresponding to those in the music.

Results showed that both Western and Mafai listeners recognized all three emotional expressions at a level above chance. Due to these findings, researchers determined that the ability to perceive emotion in music is universal. Researchers also
determined that both Westerners and Mafai listeners relied on temporal cues in order to make their judgments. Pieces with a faster tempo were more likely to be classified as happy, while pieces with a slower tempo were more likely to be classified as scared/fearful. For sad pieces, no correlation with tempo was observed. Another property of the music that influenced categorization was the mode of the piece. Both groups classified major pieces as happy, minor pieces as scared/fearful, and pieces with an indefinite mode as sad. The types of emotions perceived in music are examined further in the next study.

In a study on musical emotions, researchers determined that professional musicians are able to communicate five emotions to listeners with an accuracy equaling facial and vocal expression of emotions (Juslin & Laukka, 2003). The five emotions included happiness, sadness, anger, fear, and tenderness. In a subsequent study, the researchers determined that the five listed emotions are also the most commonly-studied in emotion literature (Juslin & Laukka, 2004). These findings suggest a need for broad emotional categories for effective emotional communication through a musical performance. More specific emotional distinctions may be difficult to communicate reliably without adding additional context; however, even if the music-emotions portrayed by a piece of music are broad, they are still subjective. No one person can claim his or her perception of the music is correct and others are wrong, an issue that complicates the study of music-emotion perception. The researchers in the following study looked to solve this problem.

To compare perceived emotions using the discrete emotion model and the dimensional model, researchers completed a pilot study using film music (Eerola & Vuoskoski, 2011). The researchers’ secondary goal, to create research material for exploring emotional processing, is discussed further for the purposes of this study. The researchers decided that film music best served the purpose of the study due to its
ability to mediate powerful emotional cues. All of the excerpts came from a variety of film genres dating from 1976 to 2006 in order to keep the sound quality relatively consistent across the excerpts. Researchers also attempted to choose unfamiliar excerpts so as to limit memories from influencing participants perceived emotions.

Seven participants rated the perceived emotion of 360 excerpts using two different scales. Participants also rated their familiarity with the music. The six emotions available to the participants to choose from included “happy”, “sad”, “tender”, “fearful”, “angry”, and “surprising”. The results showed that participants rated all music excerpts consistently, except for “surprising” excerpts, which was consequently eliminated from further analyses. Participants also reported being unfamiliar with close to 90% of the excerpts, while being very familiar with only 4%. The researchers used these findings to select 110 excerpts for use in a future experiment. Fifty of the excerpts, which included 10 of each of the five emotions, were assigned an intensity rating: 25 excerpts were high intensity and 25 were moderate intensity. The other 60 excerpts were assigned either a moderate or high rating as well as a positive or negative rating. Finally, the 60 excerpts were assigned to a valence, energy, or tension category. In doing this, the researchers created a set of excerpts for use in future studies of emotion perception.

No study to date has examined how veterans with PTSD perceive emotion in music; however, due to the comorbidity between depression and PTSD, the perception and processing of emotions in patients with major depression is explored. Researchers examined emotional processing in patients with major depression through musical, vocal, and facial emotion recognition tasks (Naranjo et al., 2011). Each participant with depression was matched with a typically functioning participant in a control group. The results showed that the participants with depression had impaired emotional processing, regardless of the stimuli used. In the music task, participants with depression rated peaceful and happy excerpts significantly less accurately than control participants, and
rated the intensity of sad and frightening music significantly higher as compared to the control group. Participants with depression also rated peaceful music as significantly less intense than the control group. Participants with depression were as accurate in their recognition of positive emotions as the control group, but displayed significantly poorer recognition of neutral emotions, as they identified the stimuli more negatively. The results suggest that the impairment in emotional processing found in people with depression is confined not only to interpersonal stimuli such as facial expressions, but in the ability to perceive and process emotions in music as well. Due to the high comorbidity of PTSD and major depression, the findings from this study may provide evidence of how adults with PTSD process music emotions.

**Summary of Related Literature**

As outlined in the previously described literature, there is a clear overlap in neural structures that are activated in music listening and emotion processing. Brain structures in the brain reward system, or limbic system, such as the amygdala, the hippocampus, and the thalamus, along with the prefrontal cortex, are activated during music listening and emotion processing. The aforementioned neurologic findings support the use of music listening to examine emotion processing. It is therefore possible to identify any differences in emotional processing and identification between typically functioning adults and adults with post-traumatic stress disorder through the use of this technique.

Due to the neural overlap, the differences in brain activation shown by individuals with PTSD as compared to individuals without PTSD can be linked to the deficits they experience in emotional processing. These emotional deficits include numbing and negative emotionality, impaired emotional processing, lowered intensity of positive emotions, and an impaired ability to perceive emotion. The same deficits might be shown in how individuals with PTSD perceive emotion in music.
Emotion is a broad topic that can be difficult to define. Researchers have developed ways to conceptualize emotion to make the study of emotion more comprehensive. Out of the three approaches discussed, this study will implement aspects of the categorical and dimensional approaches. Happiness, sadness, anger, fear, and tenderness were identified across several studies as the emotions that are most effectively communicated through a musical performance. The psychoacoustic features most responsible for conveying emotion are loudness, tempo, timbre, arousal, and pitch. Individuals with depression, a disorder that is often comorbid with PTSD, can experience impairment in emotional processing, including the processing of emotions in music.

**Implications for Mediating Models and Clinical Models**

A study in regard to the ability of individuals with PTSD to perceive emotion in music will contribute to current and future studies involving music and emotional processing in veterans with PTSD. The ability of individuals with PTSD to perceive emotion in music could change the way treatment is given or the types of therapies that are considered most effective for improving emotional processing. For example, if an individual with PTSD is more likely to respond emotionally to a musical stimulus than a written or spoken stimulus, then music should be used with that individual to work on emotional processing skills.

The results of this study could also affect how music therapy services are offered to individuals with PTSD. If an individual with PTSD is more likely to have an emotional reaction to a specific type of music, depending on the goals and objectives for that individual, using that specific type of music to experience and address those emotions in a non-threatening way could be an effective means for retraining emotion regulation. Furthermore, a study that examines the use of music therapy to improve emotional
identification and regulation in individuals with PTSD over time would be a worthwhile clinical study.

Research Questions

1. What difference exists in the categorization of music-emotions between adults with PTSD and adults without PTSD?
2. What interactions exist in the perception of music-emotion category and intensity between adults with PTSD and adults without PTSD?
CHAPTER 3

METHOD

This chapter outlines the method for this study. The inclusion and exclusion criteria for participants are described, as well as how participants were recruited. The design and variables are explained, along with the measures and materials used for this study. The procedure is described, followed by the identification of the statistical tests utilized for data analysis.

Participants

Thirty-five military veterans, both male and female, participated in this study. Eighteen participants were veterans with a primary diagnosis of post-traumatic stress disorder (PTSD) and 17 were veterans with no PTSD diagnosis. All participants were asked to report any diagnosis they have. Their responses can be seen in Table 1.

Table 1

<table>
<thead>
<tr>
<th>Disorder</th>
<th>With PTSD</th>
<th>Without PTSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Depression</td>
<td>13</td>
<td>7</td>
</tr>
<tr>
<td>Substance Dependence</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Anxiety</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Traumatic Brain Injury</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Bipolar</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Multiple Sclerosis</td>
<td>-</td>
<td>1</td>
</tr>
</tbody>
</table>

For the purposes of Veteran Affairs health benefits and services, a person who served in the active military service and was not discharged dishonorably is considered a veteran. The participants listed their active military service from 1954 to 2013. This range includes the Vietnam War, the Cold War, the Persian Gulf War, the Gulf War, Operation Enduring Freedom, and Operation Iraqi Freedom.
**Inclusion Criteria.** Veterans with and without PTSD were recruited from the Bruce W. Carter Veteran’s Affairs Hospital in Miami, Florida. Each participant with PTSD was required to meet the diagnostic criteria for PTSD as outlined in The Diagnostic and Statistical Manual of Mental Disorders (APA, 2013) as determined by a psychiatrist at the VA hospital.

**Exclusion Criteria.** Participants were excluded from the study if they had a dual diagnosis of PTSD with schizophrenia or psychosis.

**Design and Variables**

The study design used a between-subjects natural experiment design (Remler & Van Ryzin, 2011). One independent variable of person condition existed in the study with two levels, including individuals with PTSD and individuals without PTSD. Two dependent variables existed in this study, including the category of emotion and the intensity of emotion.

**Measures**

**Job Affect Scale (JAS).** The Job Affect Scale (Brief, Burke, & George, 1988), is a 20-item scale used to determine whether an individual is in a positive mood or a negative mood (see Appendix A for the Job Affect Scale). Participants rate 20 different mood descriptors based on how they currently feel on a scale ranging from 1 = Very Slightly to 5 = Extremely. The scale is scored by assigning point values to the participants’ responses which are separated into positive and negative descriptors. The lowest possible score is 10 while the highest possible score is 50 for both positive and negative affect. Brief and Roberson (1987) reported reliabilities of .88 and .84 for positive and negative affect scales respectively. The purpose of the JAS is to account for participants’ moods prior to the start of the study and how those moods, either positive or negative, affect their identification and intensity ratings of the excerpts.
**Music Emotion Rating Scale (MERS).** The Music Emotion Rating Scale is a researcher-designed scale that can be used to rate emotional content of music (see Appendix B for the Music Emotion Rating Scale). The MERS is used to determine the type of emotion the listener perceives in a musical excerpt, as well as the intensity of that emotion. In this study, the MERS took 15 to 20 minutes to administer because participants rated 25 musical excerpts. The MERS includes five emotions (happy, sad, anger, fear, love/tender) on an emotion intensity scale ranging from 0 = Low to 10 = High. These particular five emotions were chosen for this study based on an investigation of emotions perceived in music that determined the five emotions as the most commonly studied in literature (Juslin & Laukka, 2004).

**Demographic Background.** All participants completed a researcher-designed demographic background survey (see Appendix C for the demographic study). Survey items included questions related to diagnosis, age, gender, ethnicity, musical experience, two open-ended questions about the study (see Appendix D for veterans responses to the open ended questions), length of service, dates of service, and date of first enlistment.

**Materials**

The 25 musical excerpts used for this study (see Table 2 for the musical excerpts used in this study), were chosen from a study that investigated music-mediated emotions (Eerola & Vuoskoski, 2011). Researchers chose film scores from which to select the excerpts, and chose each excerpt specifically so that a listener would not recognize the associated movie. All excerpts were instrumental, as the addition of lyrics could have changed the emotional content of the excerpt. This process ensured participants had no pre-determined emotional connections to the music. The average length of each excerpt was 15 seconds and ranged from 13 to 17 seconds. The total
listening time for all excerpts was six minutes and 18 seconds. Participants had up to 15 seconds to record their answers in between each excerpt.

Table 2

Musical excerpts for music emotion rating scale task

<table>
<thead>
<tr>
<th>Emotion</th>
<th>Album Name</th>
<th>Track #</th>
<th>Min:Sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anger</td>
<td>Lethal Weapon 3</td>
<td>8</td>
<td>04:15–04:29</td>
</tr>
<tr>
<td></td>
<td>The Rainmaker</td>
<td>7</td>
<td>01:45–02:00</td>
</tr>
<tr>
<td></td>
<td>The Alien Trilogy</td>
<td>9</td>
<td>00:03–00:18</td>
</tr>
<tr>
<td></td>
<td>Cape Fear</td>
<td>1</td>
<td>02:15–02:30</td>
</tr>
<tr>
<td></td>
<td>The Fifth Element</td>
<td>19</td>
<td>00:00–00:20</td>
</tr>
<tr>
<td>Fear</td>
<td>Batman Returns</td>
<td>5</td>
<td>00:09–00:25</td>
</tr>
<tr>
<td></td>
<td>JFK</td>
<td>8</td>
<td>01:26–01:40</td>
</tr>
<tr>
<td></td>
<td>JFK</td>
<td>8</td>
<td>00:08–00:25</td>
</tr>
<tr>
<td></td>
<td>The Alien Trilogy</td>
<td>5</td>
<td>00:26–00:41</td>
</tr>
<tr>
<td></td>
<td>Hannibal</td>
<td>1</td>
<td>00:40–00:54</td>
</tr>
<tr>
<td>Happy</td>
<td>The Rainmaker</td>
<td>3</td>
<td>02:55–03:13</td>
</tr>
<tr>
<td></td>
<td>Batman</td>
<td>18</td>
<td>00:55–01:15</td>
</tr>
<tr>
<td></td>
<td>Shallow Grave</td>
<td>6</td>
<td>02:02–02:17</td>
</tr>
<tr>
<td></td>
<td>Man of Galilee CD1</td>
<td>2</td>
<td>03:02–03:18</td>
</tr>
<tr>
<td></td>
<td>Oliver Twist</td>
<td>1</td>
<td>00:17–00:34</td>
</tr>
<tr>
<td>Sad</td>
<td>The English Patient</td>
<td>18</td>
<td>00:07–00:32</td>
</tr>
<tr>
<td></td>
<td>Running Scared</td>
<td>15</td>
<td>02:06–02:27</td>
</tr>
<tr>
<td></td>
<td>The Portrait of a Lady</td>
<td>9</td>
<td>00:00–00:22</td>
</tr>
<tr>
<td></td>
<td>Big Fish</td>
<td>15</td>
<td>00:55–01:11</td>
</tr>
<tr>
<td></td>
<td>Man of Galilee CD1</td>
<td>8</td>
<td>01:20–01:37</td>
</tr>
<tr>
<td>Love/Tender</td>
<td>Shine</td>
<td>10</td>
<td>01:28–01:48</td>
</tr>
<tr>
<td></td>
<td>Pride &amp; Prejudice</td>
<td>1</td>
<td>00:10–00:26</td>
</tr>
<tr>
<td></td>
<td>Dances with Wolves</td>
<td>4</td>
<td>01:31–01:48</td>
</tr>
<tr>
<td></td>
<td>Pride &amp; Prejudice</td>
<td>12</td>
<td>00:01–00:15</td>
</tr>
<tr>
<td></td>
<td>Oliver Twist</td>
<td>8</td>
<td>00:14–00:30</td>
</tr>
</tbody>
</table>
The researcher selected each excerpt from a larger selection of excerpts. Each excerpt chosen was rated as having high emotional intensity to ensure the effective portrayal of the specified emotion. Specific music-emotions portrayed in each excerpt used different psychoacoustic features that are specific to certain music-emotions. Happiness is perceived in music with fast tempo and small tempo variability, major mode, simple harmony, medium-high sound level, wide pitch range, bright timbre, and large articulation variability. Sadness is perceived in music with slow tempo, minor mode, dissonance, low sound level, narrow pitch range, sharp timbre, and small articulation variability. Anger is perceived in music with fast tempo and small tempo variability, minor mode, dissonance, high sound level, small pitch variability, sharp timbre, and moderate articulation variability. Fear is perceived in music with fast tempo and large tempo variability, minor mode, dissonance, low sound level, wide pitch range, soft timbre, and large articulation variability. Finally, tenderness is perceived in music with slow tempo, major mode, consonance, medium-low sound level, a fairly narrow pitch range, soft timbre, and small articulation variability (Juslin & Laukka, 2004).

The excerpts were played on an Asus N53SV-XR1 laptop, as well as an LG G3 smartphone, using a set of Sony portable speakers and a Photive Cyren Bluetooth speaker. The participants completed the task on a print copy of the MERS with a pencil. The administrator read a script detailing the instructions for the task before the task began (see Appendix E for the Music Emotion Rating Task instructions).

**Procedure**

Participants were recruited from the Veteran’s Affairs Hospital of Miami. An on-staff music therapist at the VA hospital, acting as the primary investigator for the VA, received referrals for appropriate participants from psychiatrists on the PTSD unit. The music therapist also referred veterans with PTSD to this researcher. Each referred participant was given an advertisement (see Appendix F for the advertisement)
explaining the study and the requirements to participate. At the start of the study, this researcher conducted the informed consent process with every participant (see Appendix G for the informed consent forms). The process consisted of obtaining participants’ names, birthdates, social security numbers, and signatures. All participants were given the Job Affect Scale, the Music Emotion Rating Scale, and the demographic survey on a clipboard, and a pencil. When completing the Job Affect Scale, Participants were instructed to rate 20 mood descriptors based on how they were currently feeling. When all participants had completed the affect scale, the researcher read a script with instructions on how to complete the music listening task.

Participants were instructed to listen to each musical excerpt, identify the emotion being portrayed by circling one of five listed options (“happy”, “sad”, “anger”, “fear”, “tender/love”), and rate the intensity of the emotion on a scale of zero (low) to ten (high). Participants were given one practice item to complete before the exercise began. Twenty-five excerpts were played in a random order determined before the collection of any data, with five excerpts representing each of the five emotions. Each excerpt ranged in length from 15 to 30 seconds, was from a major film or motion picture, and was selected from previous research (Eerola & Vuoskoski, 2011). After completing the music listening task, participants were instructed to complete the demographic survey.

Data Collection

Data were collected by appointment from participants in one of the two music therapy offices or the Day Activities Center at the Miami Veterans Affairs hospital. The researcher met with participants in small groups or one-on-one, schedule permitting. The data collected by the researcher included participant response to the Job Affect Scale, participants’ responses to the music listening task, and the demographic survey. To account for missing data on the music listening task, any unanswered questions were
counted as incorrect. To account for missing data on the Job Affect Scale, the average of the participants' scores for the corresponding affect type was applied.

**Data Analysis**

This researcher completed five chi-square analyses to determine any differences in the categorization of music-emotions between veterans with PTSD and veterans without PTSD. The researcher then completed 25 chi-square analyses to determine if all participants identified each music-emotion at a level above chance. A t-test analyses was completed to determine if there was a significant difference in positive affect score and negative affect score between veterans with and without PTSD. Finally, a between-subjects analysis of covariance (ANCOVA) was completed to determine any significant main effects or interactions amongst the perception of music-emotion category and intensity between veterans with PTSD and veterans without PTSD while controlling for the effect of baseline mood. Only the intensities of the correctly identified emotions were taken into account for these tests. The researcher assessed ANCOVA assumptions of the covariates correlating with the dependent variables, sphericity, homogeneity, normality, and independence. All assumptions were met, except for sphericity and homogeneity. Data was analyzed using the Statistical Package for the Social Sciences, version 22 (SPSS).
CHAPTER 4

RESULTS

In this chapter, the data collected for this study are analyzed. A between-subjects natural experiment design (Remler & Van Ryzin, 2011) was implemented in this study. The independent variable of person condition had two levels: individuals with PTSD and individuals without PTSD. The two dependent variables were the category of emotion and the intensity of emotion. A measure of state mood was used to control for mood effects on music-emotion perception.

The first research question of this study explored whether differences existed in the categorization of emotions in music between individuals with and without PTSD. The second research examined whether any interactions existed in the perception of the category of music-emotions and the intensity of emotions between individuals with and without PTSD. Each participant took part in one 45-minute music listening task to identify emotion and emotion intensity of 25 musical excerpts.

Participants

A total of 18 individuals with PTSD and 17 individuals without PTSD participated in this study. Of the 18 individuals with PTSD 16 were male and 2 were female. Of the 17 individuals without PTSD, 13 were male and 4 were female. The mean age of the individuals with PTSD was 49 years ($SD=13.88$). The mean age of the individuals without PTSD was 54 years ($SD=13.70$). Of the 18 participants with PTSD, four were White, eight were Hispanic, three were Black or African American, two were of multiple-race, and one was considered other. Of the 17 participants without PTSD, five were White, two were Hispanic, seven were Black or African American, one was of multiple-race, and two were considered other. All 35 participants were recruited from the Bruce W. Carter Veterans Affairs Hospital of Miami, Florida. All of the demographic characteristics can be found in Table 3.

27
<table>
<thead>
<tr>
<th>Demographic Variables</th>
<th>With PTSD</th>
<th>Without PTSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>16</td>
<td>13</td>
</tr>
<tr>
<td>Female</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Average Age (in years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M=49, SD=13.88</td>
<td>M=54, SD=13.70</td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Hispanic or Latino</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Black or African American</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Asian/Pacific Islander</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Multiple Race</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Musical Training (in years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-2</td>
<td>14</td>
<td>8</td>
</tr>
<tr>
<td>3 or More</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Mean Music Listening in a Day (in hours)</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Military Service (in years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-10</td>
<td>11</td>
<td>15</td>
</tr>
<tr>
<td>11-20</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>21-30</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>31 or More</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>
Descriptive Results

The descriptive results that appear in Table 4 include the number and percentage of correct responses given during the music listening task for participants with and without PTSD. A response was considered correct if the participant’s answer matched the emotion intended by the music as determined by Eerola and Vuoskoski (2011). Veterans with PTSD identified a larger percentage of excerpts correctly than veterans without PTSD in four out of the five emotion categories, including “happy”, “sad”, “anger”, and “fear”. In the fifth category, “fear”, veterans with and without PTSD identified the same percentage of excerpts correctly. In all but one emotion category, at least one excerpt was identified under 50% of the time. The emotion with the lowest number of correct responses from both participants with and without PTSD was “anger” with 60% and 51% correct responses, respectively. The emotion with the most correct responses from participants with PTSD was “fear” with 74 correct responses out of 90, or 82%. The emotion with the most correct responses from participants without PTSD was “happy” with 68 correct responses out of 85, or 80%.
<table>
<thead>
<tr>
<th>Excerpt</th>
<th>With PTSD</th>
<th>Without PTSD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number Correct</td>
<td>Percentage</td>
</tr>
<tr>
<td>Happy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>16</td>
<td>89%</td>
</tr>
<tr>
<td>2</td>
<td>17</td>
<td>94%</td>
</tr>
<tr>
<td>3</td>
<td>17</td>
<td>94%</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
<td>89%</td>
</tr>
<tr>
<td>5</td>
<td>7</td>
<td>39%</td>
</tr>
<tr>
<td>Total</td>
<td>73</td>
<td>81%</td>
</tr>
<tr>
<td>Sad</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>14</td>
<td>78%</td>
</tr>
<tr>
<td>2</td>
<td>11</td>
<td>61%</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
<td>83%</td>
</tr>
<tr>
<td>4</td>
<td>13</td>
<td>72%</td>
</tr>
<tr>
<td>5</td>
<td>7</td>
<td>39%</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>67%</td>
</tr>
<tr>
<td>Anger</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>10</td>
<td>56%</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>50%</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>61%</td>
</tr>
<tr>
<td>4</td>
<td>14</td>
<td>78%</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>56%</td>
</tr>
<tr>
<td>Total</td>
<td>54</td>
<td>60%</td>
</tr>
<tr>
<td>Fear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>16</td>
<td>89%</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>83%</td>
</tr>
<tr>
<td>3</td>
<td>14</td>
<td>78%</td>
</tr>
<tr>
<td>4</td>
<td>15</td>
<td>83%</td>
</tr>
<tr>
<td>5</td>
<td>14</td>
<td>78%</td>
</tr>
<tr>
<td>Total</td>
<td>74</td>
<td>82%</td>
</tr>
<tr>
<td>Love/Tender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>16</td>
<td>89%</td>
</tr>
<tr>
<td>2</td>
<td>14</td>
<td>78%</td>
</tr>
<tr>
<td>3</td>
<td>14</td>
<td>78%</td>
</tr>
<tr>
<td>4</td>
<td>13</td>
<td>72%</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>22%</td>
</tr>
<tr>
<td>Total</td>
<td>61</td>
<td>68%</td>
</tr>
</tbody>
</table>

aOut of 18 possible  
bOut of 17 possible
The descriptive results shown in Table 5 include the means and standard deviations for the emotion intensity ratings given by veterans with and without PTSD. Participants with PTSD rated the intensity of the “happy”, “sad”, and “love/tender” excerpts, lower than participants without PTSD. The average intensity ratings given to all “happy” excerpts by veterans with and without PTSD were 6.58 and 7.59 respectively. The average intensity rating given to all “sad” excerpts by veterans with and without PTSD was 6.02 and 6.49 respectively. The average intensity rating given to all “love/tender” excerpts by veterans with and without PTSD was 6.12 and 7.07 respectively. For the “anger” excerpts, participants with and without PTSD on average rated the intensity similarly. The average intensity ratings given to all anger excerpts by veterans with and without PTSD were 7.03 and 7.16 respectively. Participants with PTSD rated the intensity of the “fear” excerpts higher than participants without PTSD. The average intensity rating given to all “fear” excerpts by veterans with and without PTSD was 7.26 and 6.11 respectively.
Table 5

Means and standard deviations of intensity of music emotion categories

<table>
<thead>
<tr>
<th>Intensity</th>
<th>With PTSD(^a)</th>
<th>Without PTSD(^b)</th>
<th>All(^c)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Happy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>6.61</td>
<td>2.61</td>
<td>7.35</td>
</tr>
<tr>
<td>2</td>
<td>6.78</td>
<td>2.55</td>
<td>7.29</td>
</tr>
<tr>
<td>3</td>
<td>7.72</td>
<td>2.44</td>
<td>9.06</td>
</tr>
<tr>
<td>4</td>
<td>6.56</td>
<td>2.66</td>
<td>7.82</td>
</tr>
<tr>
<td>5</td>
<td>5.22</td>
<td>3.47</td>
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<tr>
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<td>1.85</td>
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<tr>
<td>2</td>
<td>5.78</td>
<td>2.23</td>
<td>6.35</td>
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<td>3</td>
<td>6.33</td>
<td>2.74</td>
<td>6.65</td>
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<td>4</td>
<td>5.67</td>
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<td>6.18</td>
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<tr>
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<td>6.17</td>
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<tr>
<td>Anger</td>
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<tr>
<td>1</td>
<td>7.72</td>
<td>1.56</td>
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<td>2</td>
<td>7.56</td>
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<td>6.39</td>
<td>2.35</td>
<td>6.53</td>
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<td>6.94</td>
<td>1.79</td>
<td>6.76</td>
</tr>
<tr>
<td>5</td>
<td>6.56</td>
<td>1.38</td>
<td>6.88</td>
</tr>
<tr>
<td>Fear</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>7.67</td>
<td>1.74</td>
<td>7.24</td>
</tr>
<tr>
<td>2</td>
<td>7.17</td>
<td>1.75</td>
<td>5.94</td>
</tr>
<tr>
<td>3</td>
<td>6.72</td>
<td>1.67</td>
<td>5.29</td>
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<td>4</td>
<td>7.56</td>
<td>2.17</td>
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<td>5</td>
<td>7.17</td>
<td>2.06</td>
<td>5.94</td>
</tr>
<tr>
<td>Love/Tender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>7.11</td>
<td>2.32</td>
<td>7.88</td>
</tr>
<tr>
<td>2</td>
<td>6.22</td>
<td>2.51</td>
<td>8.12</td>
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<tr>
<td>3</td>
<td>6.56</td>
<td>2.06</td>
<td>7.00</td>
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<td>4</td>
<td>5.22</td>
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<tr>
<td>5</td>
<td>5.50</td>
<td>1.65</td>
<td>5.59</td>
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</table>

\(^a\)18 participants
\(^b\)17 participants
\(^c\)35 participants
The descriptive results shown in Table 6 include the overall means and standard deviations for the intensities of only the correctly identified emotions by veterans with and without PTSD. Veterans with PTSD, on average, rated the intensity of “fear” excerpts higher than veterans without PTSD. Veterans without PTSD, on average, rated the intensity of “happy” and “love/tender” excerpts higher than veterans with PTSD. Veterans with PTSD, on average, rated the intensity of “sad” and “anger” excerpts similarly to veterans without PTSD. These findings are also depicted in Figure 1.

Table 6
Means and standard deviations of intensity of correctly identified emotion

<table>
<thead>
<tr>
<th>Intensity</th>
<th>With PTSD</th>
<th>Without PTSD</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Happy</td>
<td>6.90</td>
<td>2.21</td>
<td>8.06</td>
</tr>
<tr>
<td>Sad</td>
<td>6.05</td>
<td>1.37</td>
<td>6.07</td>
</tr>
<tr>
<td>Anger</td>
<td>7.14</td>
<td>1.35</td>
<td>7.28</td>
</tr>
<tr>
<td>Fear</td>
<td>7.73</td>
<td>0.93</td>
<td>6.20</td>
</tr>
<tr>
<td>Love/Tender</td>
<td>6.56</td>
<td>2.11</td>
<td>7.32</td>
</tr>
</tbody>
</table>

Figure 1. Mean emotional intensity of correctly identified emotion
Inferential Analysis Results

Inferential analysis results of the five chi square tests showed that no differences were observed between veterans with and without PTSD in categorization of music-emotions (all $p > .137$). Together, all participants were able to significantly identify four out of five “happy” and “sad” excerpts, one out of five “anger” excerpts, five out of five “fear” excerpts, and three out of five “love/tender” excerpts at a level above chance.

The inferential statistics shown in Table 7 display the results of the $t$-test analysis on mood scores. Compared to individuals without PTSD, individuals with PTSD reported significantly higher negative baseline mood scores ($t(33)=2.359, p=.024$). No significant differences were observed for positive mood scores.

<table>
<thead>
<tr>
<th>Table 7</th>
<th>Means and standard deviations of baseline affect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mood$^a$</td>
<td>With PTSD</td>
</tr>
<tr>
<td></td>
<td>$M$</td>
</tr>
<tr>
<td>Positive</td>
<td>33</td>
</tr>
<tr>
<td>Negative</td>
<td>26</td>
</tr>
</tbody>
</table>

$^a$Scores range from 10-50 with 50 being high and 10 being low scores for both positive and negative affect.

The inferential statistics shown in Table 8 display the results of the analysis of covariance (ANCOVA). Data were analyzed using a repeated measures ANCOVA with a within-subjects factor of emotion (“happy”, “sad”, “anger”, “fear”, and “love/tender”), a between-subject factor of PTSD (with and without), and a covariate of negative affect score. Mauchly’s test indicated that the assumption of sphericity had been violated ($x^2(9)=34.26, p=.00$), therefore degrees of freedom were corrected using Huynh-Feldt estimates of sphericity ($\varepsilon = 0.74$). A violation of homogeneity also occurred, thus the
tests of between-subjects effects significance value was lowered (alpha=.025). No main effect of music-emotion intensity emerged when accounting for baseline participant affect scores, and no significant differences were found between subjects. There were also no significant interactions. The interaction between music-emotion intensity and group, however, had a medium effect size, the highest effect size of any interaction (Partial $\eta^2=.091$). Further analysis showed that the differences between intensity and group may have occurred between veterans with and without PTSD in the “fear” and “happy” categories as shown in Figure 2.

Table 8
Analysis of covariance for music-emotion (ME) intensity by group and affect scores

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>$df$</th>
<th>MS</th>
<th>$F$</th>
<th>$p$</th>
<th>Partial $\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME Intensity</td>
<td>3.47</td>
<td>2.97</td>
<td>1.17</td>
<td>5.10</td>
<td>.674</td>
<td>.019</td>
</tr>
<tr>
<td>ME Intensity x PAS</td>
<td>2.61</td>
<td>2.97</td>
<td>0.88</td>
<td>0.38</td>
<td>.763</td>
<td>.014</td>
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<tr>
<td>ME Intensity x NAS</td>
<td>9.86</td>
<td>2.97</td>
<td>3.32</td>
<td>1.45</td>
<td>.235</td>
<td>.051</td>
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<tr>
<td>ME Intensity x Group</td>
<td>18.30</td>
<td>2.97</td>
<td>6.16</td>
<td>2.69</td>
<td>.052</td>
<td>.091</td>
</tr>
<tr>
<td>Error (Emotion)</td>
<td>183.71</td>
<td>80.21</td>
<td>2.29</td>
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<td></td>
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<tr>
<td>PAS</td>
<td>12.40</td>
<td>1</td>
<td>12.40</td>
<td>1.63</td>
<td>.212</td>
<td>.057</td>
</tr>
<tr>
<td>NAS</td>
<td>5.40</td>
<td>1</td>
<td>5.40</td>
<td>0.71</td>
<td>.407</td>
<td>.026</td>
</tr>
<tr>
<td>PTSD</td>
<td>6.74</td>
<td>1</td>
<td>6.74</td>
<td>0.89</td>
<td>.355</td>
<td>.032</td>
</tr>
<tr>
<td>Error</td>
<td>205.20</td>
<td>27</td>
<td>7.60</td>
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</tbody>
</table>
Research Question #1: What differences exist in the categorization of emotions in music between adults with PTSD and adults without PTSD?

Null Hypothesis #1. There will be no difference in the categorization of emotions in music between adults with and without PTSD. This researcher failed to reject this null hypothesis. Five chi square analyses indicated there was no statistically significant difference between veterans with and without PTSD in how they categorized music-emotions (all \( p > .137 \)).

Research Question #2: What interactions exist in the perception of emotions category and intensity between adults with PTSD and adults without PTSD?

Null Hypothesis #2. There will be no interaction between perception of emotion category and intensity between adults with and without PTSD. This researcher failed to reject this null hypothesis. An ANCOVA analyses indicated there was no statistically significant main effect of music-emotion intensity (\( F_{(2,97,80.21)} = 5.10, p = .674 \)). There were
also no statistically significant interactions, however, the interaction between music-emotion intensity and group had a medium effect size (Partial $\eta^2=.091$).
CHAPTER 5
DISCUSSION

This chapter provides an interpretation of the study results in light of previous related literature. Further, the study’s limitations and implications for future research are discussed. Finally, the clinical and theoretical implications are outlined.

Overview

The purpose of this study was to determine whether veterans with PTSD perceive music-emotions differently than veterans without PTSD. Data were analyzed to compare veterans with PTSD to veterans without PTSD in their ability to correctly categorize music-emotions. Music-emotion categories included “happy”, “sad”, “anger”, “fear”, and “love/tender”. Additionally, participants were asked to rate the intensity of the emotion on a scale from 0 to 10. The music-emotion category and intensity ratings of veterans with PTSD were compared to those of veterans without PTSD. The statistical analyses showed no significant differences between veterans with and without PTSD in their categorization of music-emotions. A lack of statistical significance also existed in all interactions. The interaction of music-emotion intensity and group, however, had the largest effect size of any interaction. Further analyses showed that veterans with PTSD tended to rate “fear” excerpts more intensely than veterans without PTSD. Additionally, veterans without PTSD tended to rate “happy” excerpts more intensely than veterans with PTSD, although not significantly.

Review of Research Questions

Categorization of Music-Emotions. The results showed no significant difference in the number of music-emotions correctly identified between veterans with and without PTSD. As no previous research has explored music-emotion perception in veterans with PTSD, a music perception study of individuals with depression was used for comparison purposes (Naranjo et al., 2011). The findings in this study contradict the
findings of the previous research, as individuals with depression identified significantly fewer emotions correctly in music than typically functioning individuals. This researcher attributes these differences in results to the difference in population. While depression can be comorbid with PTSD, it is not the same disorder and the difficulties common to both disorders may present differently. Individuals with depression were also compared to a healthy, typically functioning population. The participants with PTSD were compared to veterans with other diagnoses or disorders. The diagnoses of the comparison group may have affected their perception of the music-emotions.

The ability of veterans with PTSD to perceive music-emotions the same as veterans without PTSD shows that music is an effective stimulus for emotion identification. Veterans with PTSD do not need to be taught this skill, saving treatment time and monetary cost. After identifying emotions in music, veterans with PTSD can begin to identify those same emotions in themselves. It is only after they identify their own feelings and emotions that they can begin to process them and learn how to appropriately cope with them.

Another finding from this study that contradicts previous research is that all participants did not identify eight of the 25 musical excerpts above a level of chance. The excerpts used for this study were selected from previous research that identified the emotion portrayed in 110 musical excerpts for objective research in music-emotion perception (Eerola & Vuoskoski, 2011). This researcher attributes these differences to the participants recruited for each study. In the study completed by Eerola and Vuoskoski, the individuals who identified the music-emotions of the excerpts were expert musicologists who had all studied musical instruments for 10 years or more. While the participants in the current study may have had some formal training in music, none of them had the experience of the individuals from the previous study. Additionally, music is inherently subjective. Even though a large number of people may agree that a piece of
music is portraying a certain emotion, there will always be a group of people that hear something different. Even the excerpts in this study that had high identification rate had individuals that perceived the music-emotions differently.

Finally, the finding that four of the five “anger” excerpts were not identified by all participants at a level above chance is consistent with other literature. Negative emotions, such as anger, tend to have more labels than positive emotions, causing confusion when labeling negative emotional stimuli (Britton, Taylor, Sudheimer, & Liberzon, 2006). Negative emotions also tend to elicit a more intense response than positive emotions which may lead to a more complex profile and increased difficulty in labeling. The fact that all participants were able to identify all five “fear” excerpts at a level above chance is a surprising finding due to this information about the labeling of negative emotions. This finding may suggest that music is an effective stimulus for portraying fear, but not anger.

**Interactions in Music-Emotion Category and Intensity between Groups.** The results indicated no statistically significant interactions in music-emotion category and intensity between participant groups. The interaction between music-emotion intensity and group, however, had a medium effect size; the largest effect size of any interaction. This finding suggests that significance could be achieved if the study were replicated in a way that increased the power through the addition of participants.

Further analyses showed that the differences may have occurred between veterans with and without PTSD in their rating of “fear” and “happy” excerpts. These findings support previous research which found that individuals with depression rate “fear” and “happy” music more and less intense respectively as compared to typically functioning individuals (Naranjo et al., 2011). The individuals with depression, however, also rated “sad” music as more intense than typically functioning individuals. In the current study, results revealed no significant difference between groups and “sad”
excerpts. Thus, while individuals with PTSD and depression may have similar emotion perception and processing deficits when it comes to fear and happiness, they differ in their perception and processing of sadness.

The response to “fear” excerpts displayed by veterans with PTSD may reflect atypical amygdala function. The amygdala is a structure of the brain known to be active during emotional processing, especially for fear emotions (Koelsch & Siebel, 2005). This hypothesis supports findings that showed abnormalities in amygdala function during the acute phase of PTSD (Armony, Corbo, Clment, & Brunet, 2005). The tendency of veterans with PTSD to rate the intensity of “happy” excerpts lower than veterans with PTSD also suggests a processing abnormality in brain reward system structures, a hypothesis supported by previous findings (Elman et al., 2009).

Berlyne (1971a) postulates another explanation for the differences in intensity ratings of “fear” and “happy” excerpts. Berlyne’s arousal theory states that works of art, including music, can affect physiological activity, which in turn affects behavioral states. A heightened state of physiological activity, or arousal, leads to a heightened sensitivity in sensory organs, sensory pathways, and the central nervous system. In this state, the processing of sensory information occurs at an enhanced rate with increased detail. These same sensory pathways, however, can become blocked or desensitized during times of intense arousal when the brain is only able to focus on the intense stimuli, blocking out any others (Berlyne, 1971b).

Based on Berlyne’s theory and the findings from this study, veterans with PTSD may have a prolonged, intense arousal to stimuli that cause fear due to their trauma, causing positive emotions to be blocked or desensitized. In the case of this study, the veterans with PTSD perceived the “fear” excerpts intensely and may have been somewhat desensitized to the “happy” excerpts. During and after the music listening task, however, no veteran with PTSD reported feeling intense fear. This finding suggests
that music may be an effective medium in helping veterans with PTSD identify and process their emotions in a way that feels safe and non-threatening.

**Anecdotal Observations**

As part of the demographic survey, participants were asked to answer three open-ended questions. Many of the participants reported enjoying the music and the study overall. The majority of the responses were positive with the negative responses referring to a dislike of certain excerpts. Surprisingly, a large number of participants stated their gratitude for the study. Some stated their beliefs on how important music and music therapy is to their recovery, while others shared hope that this study would improve treatment for veterans with a variety of diagnoses.

**Limitations and Implications for Future Research**

Several limitations existed in this research study. First, the PTSD group was not compared to a healthy veteran group. Further, certain musical excerpts were not identified at a level above chance. Finally, each group had a lower than desired number of participants, making generalization of results to the entire PTSD population difficult.

The first limitation of the study was the fact that participants in the group without PTSD had other diagnoses that may have affected their responses. While recruitment solely at the Miami VA Hospital made the study review and collection of data simpler, finding participants without any diagnoses was difficult. The majority of diagnoses found at the Miami VA Hospital are mental health disorders. Diagnoses reported by veterans in the group without PTSD included depression, substance abuse, and bipolar disorder; diagnoses that can affect perception of sensory stimuli. A fully healthy veteran population control group may have produced different results.

Another limitation of this study existed in that the emotions of several excerpts were not identified correctly by participants at a level above chance. When accounting for all of the participants’ responses, eight of the 25 musical excerpts were not identified
above chance. Four of the eight excerpts came from the “anger” category, two from the “love/tender” category, and one from both the “happy” and “sad” categories. Even though excerpts were selected to specifically portray a certain emotion, personal perceptions of music-emotions can be subjective. Giving participants the option of an open-ended response might result in responses that are similar to the five listed emotions, but articulated with different labels by the participants.

The final limitation of this study was the number of participants recruited. The majority of participants in this study were on inpatient units at the Miami VA Hospital. Veterans on inpatient units are often admitted for several months, which makes patient turnover infrequent. Recruitment of the number of participants needed for generalizable results would take a long period of time. More participants may also help findings reach significant levels and provide more power. If this study is replicated, the use of a larger sample size is recommended.

Areas for future research with veterans with PTSD may include mood induction through music and the effect of memory on perception of music-emotions. In responses to the open ended questions, many of the veterans reported feeling certain emotions while listening to the music. Determining whether the mood induction through music differs between veterans with and without PTSD would be a worthwhile study. Comments about how the music brought up memories of certain times, places, and events were also stated in the open-ended questions. The examination of how memory affects the perception of emotion in veterans with PTSD would further the understanding of emotional processing deficits in this population.

**Theoretical Implications**

Theoretically, this research provides insight into the ability of veterans with PTSD to identify emotion in music. This study suggests that no difference exists in perception of music-emotions between veterans with PTSD and veterans without PTSD. These
findings fill a gap in the existing research on veterans with PTSD and music. These findings also suggest that music-emotion identification plays little to no part in the difficulties with emotional processing veterans with PTSD experience.

The finding that veterans with PTSD tended to rate “fear” intensity higher than veterans without PTSD supports other findings of heightened negative emotionality in veterans with PTSD (Wolf, Miller, & McKinney, 2009; Armony, Corbo, Clement, & Brunet, 2005). This finding, along with the tendency that veterans with PTSD rated the intensity of “happy” excerpts lower than veterans with PTSD, demonstrates the difficulties veterans with PTSD experience with emotional processing.

Clinical Implications

The results of this study show that veterans with and without PTSD tend to identify music-emotions similarly. This ability could help veterans with PTSD learn to identify their own emotions, which in turn can help them process those emotions (Carr, et al., 2011). Processing the thoughts and feelings related to a trauma is difficult for veterans with PTSD, requiring them to re-live the experience. In many treatment facilities, this type of emotional processing is often done through talking or writing about trauma which is a daunting task for many veterans. Music therapy could be a less threatening way for veterans with PTSD to process their emotions. Through this study, “fear,” an emotion that veterans with PTSD struggle with (Tull, Barrett, McMillan, & Roemer, 2007), was found to be easily identified and intensely rated when heard in music. If veterans can process their own fear through music, they can begin to build skills to cope with fear.

Summary and Conclusions

The purpose of this study was to determine whether veterans with PTSD perceive emotions in music differently than veterans without PTSD. Participants took
part in one 45-minute music listening task to identify the emotion and emotion intensity of 25 musical excerpts.

Results indicated that there was no statistically significant difference between veterans with and without PTSD in how they categorized music-emotions. Results also indicated that there was a large effect size and a trend towards a significant interaction between music-emotion intensity and participant group. The reported interaction may have occurred between veterans with and without PTSD in their rating of “fear” and “happy” intensities. This researcher postulates that the differences in intensity ratings are due to abnormal functioning in the amygdala as well as other structures in the brain reward system ultimately caused by the veterans trauma. The abnormal functioning causes veterans with PTSD to have intense perceptions of fear, and desensitizes their perceptions of happiness and other positive emotions, as shown in this study. The fact that no veteran reported feeling intense levels of fear during or after the music listening task suggests that music may be an effective medium in helping veterans with PTSD identify and process their emotions in a way that feels safe and non-threatening.
References


Appendix A: Job Affect Scale

Instructions

Below, you will find a list of words which a person may use to describe one’s feelings. Using the scale provided, indicate how you feel at this moment using the following scale. Please be open and honest in your responding.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slightly</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Active
2. Calm
3. Distressed
4. Sleepy
5. Strong
6. Excited
7. Scornful
8. Hostile
9. Enthusiastic
10. Dull
11. Fearful
12. Relaxed
13. Peppy
14. At Rest
15. Nervous
16. Drowsy
17. Elated
18. Placid
19. Jittery
20. Sluggish
APPENDIX B: Music Emotion Rating Scale

Directions: You will listen to 25 musical excerpts. Please choose the emotion the music is trying to portray.
1. Circle the word the best fits the emotion of the music
2. Circle the number the best fits the intensity of the emotion

### PRACTICE ITEM

<table>
<thead>
<tr>
<th>Happy</th>
<th>Sad</th>
<th>Anger</th>
<th>Fear</th>
<th>Love/Tender</th>
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</thead>
<tbody>
<tr>
<td>[</td>
<td></td>
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0 1 2 3 4 5 6 7 8 9 10
Low High
TEST ITEMS

#1

<table>
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#2

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#3

<table>
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<th>Fear</th>
<th>Love/Tender</th>
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<tr>
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<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Low</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>7</td>
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#4

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<th>Love/Tender</th>
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<tr>
<td>0</td>
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</tr>
<tr>
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APPENDIX C: Demographic Background Survey

Directions: For questions 1 and 3-6, please circle one option. For questions 2 and 7-13, please provide a short written answer.

1. Circle any of the following diagnoses that apply to you.
   - Post-traumatic stress disorder
   - Major Depression
   - Substance Dependence
   - Other ________________________________

2. What is your age? __________

3. What is your gender?
   - Male
   - Female
   - Transgender

4. Please specify your race.
   - White
   - Hispanic or Latino
   - Black or African American
   - Asian/Pacific Islander
   - Multiple Race
   - Other

5. Do you consider yourself Hispanic or Latino?
   - Yes
   - No

6. How many years of formal music training have you had?
   - 0-2
   - 3 or more

7. On average, how many hours do you listen to music a day?
   _____ Hour(s) _____ Minutes
8. What was your experience with this music listening study?

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

9. Please describe any thoughts, feelings, or reactions you had to the music.

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

10. What is/was your length of service in the military? ________ years

11. What year did you first enlist in the military?  ______________

12. What years did you serve in the military?

________________________________________________________________

13. Please feel free to write any additional comments.

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
APPENDIX D: Veterans Responses to Open Ended Questions

Listed below are several of the responses given by participants to the three open ended questions on the demographic survey.

Question 1: What was your experience with this music listening study?

With PTSD

“It was very relaxing and enjoying. Music helps me relax. I have a lot of medical issues and music is a great help for me!”

“I feel how my sadness and fear were going up and down in the scale.”

“I like the fact that there was not any words, so you could capture the full emotion of the music.”

“I felt like the music accompanied scenes from a movie. The louder the volume, in most cases, the more angry and irritable I felt.”

“Made me aware of the very different reactions that music brings. Different music can create and bring out different feelings.”

“It was interesting and enjoyable. Writing down how you feel about music and how intense those feelings are seems like a great way to understand the relationship between music and feeling.”

Without PTSD

“I wish there were more selections for feelings”

“I really enjoyed myself because it was my first time doing something like this and I like it very much.”

“I love and live with music.”

“The music all fit within one category, but I felt like there were many other adjectives I wanted to add to it. I found myself reacting strongly to each piece, probably because music is my main source of emotional expression.”

“Interesting. I was surprised by my reaction to the variations.”

“I got to learn how music can change moods or even be used as a way to manipulate negativity.”
Question 2: Please describe any thoughts, feelings, or reactions you had to the music.

With PTSD

“Ttry to put myself in the music as I am playing the part. I seem to enjoy that. It helps me forget all my problems with my PTSD and anxiety.”

“The music evoked/aroused feelings of joy sadness, startly reactions and evoked involuntary startle responses.”

“It was all classical in form and I often listen to and extract emotions from it.”

“Anger as music volume was increased, ex. Blaring horns or loud drums made me irritable.”

“I relate all the pieces to scenes in the movies making it easier to have feeling to each piece.”

“Some very good, some I really didn’t enjoy, some I really, really hated.”

“The thought of relaxing on a beach.”

“It was somewhat of a brief rollercoaster of feelings. Some were sad but intense, while others were happy or angry and not as intense.”

“I was a mix of feelings, most of them sad or fear.”

“My feelings ranged from happy to sad. I also felt a surge of fear and anger with some selections.”

Without PTSD

“4-5 songs reminded me of my past.”

“I felt calm and relaxed, I did enjoy myself.”

“I was surprised it was just classical music. I don’t listen to it much.”

“Hoping this exercise enables a disabled veteran to move closer to rehabilitation.”

“Memories of high school band.”

“Some sounds made me experience strong emotions.”

“I was surprised that some tracks that were loud and fearful made me angry.”
Question 3: Please feel free to write any additional comments.

With PTSD

“I believe music is a vital part to helping soldiers with their PTSD, anxiety, depression, etc. There is a song for all of us to hear to help us relax.”

“Thanks for this opportunity.”

“Thank you for thinking of veterans for this study. With both wars extending so long and consisting of mostly urban combat, I appreciate that you took the time to investigate with your masters thesis the possibilities of music therapy and its healing power for veterans. Sincerely, thank you, these tools may help us integrate better.”

“I hope this helps someone.”

Without PTSD

“I would like to do more of these tests.”

“Great study.”
Appendix E: Music Emotion Rating Task Instructions

This task involves identifying the emotion of the music and how strong the emotion sounds to you.

1. You will listen to 25 different musical selections. On the sheet in front of you, there are test items with the emotions “Happy”, “Sad”, “Anger”, “Fear”, and “Love/Tender” listed, and beneath each test item, a scale that is numbered from 0 to 10. For each excerpt you hear, circle the emotion you feel best fits the music.

2. You will then circle a number that best fits the intensity of the emotion you circled, with 0 being “low intensity” and 10 being “high intensity”. Intensity refers to how strong the emotion is; for example, if you feel the music is sad, how sad is it? If you feel the music is not sad at all you should circle 0. If you feel the music is extremely sad you should circle 10.

3. Each excerpt will range in length from 15 to 30 seconds. After the excerpt has played, you will have 15 seconds to record your answers before the next excerpt will be played. Before you begin the test items, you will complete one practice item.

*PLAY PRACTICE ITEM

Are there any questions? We will now begin the task. Before each excerpt, I will state the test item number. Please start with test item number one.

*PLAY TEST ITEMS

*STATE EACH TEST ITEM NUMBER BEFORE PLAYING THE EXCERPT

This concludes the Music Emotion Rating Task. Thank you for your participation.
ENJOY LISTENING TO MUSIC?

If you are a veteran with or without PTSD and enjoy listening to music, you may be eligible for this study:

Music and Emotion in Veterans with Post-Traumatic Stress Disorder

The purpose of this study is to determine how veterans with PTSD recognize emotions in music. You will be asked to listen to several short music pieces and to indicate the type of emotion you hear in the music from a given list. This is a research study and should not be confused for treatment.

The study only takes 45 minutes!

To participate or for more information, please contact the primary investigator, Shawn Buller, MM, MT-BC, VA music therapist, at (305-575-7000 ext. 4145) or at (B831)
Appendix G: Informed Consent Forms

VA Research Consent Form

Title of Study: Perception of Music-Emotion in Veterans with Post-Traumatic Stress Disorder

Principal Investigator: Shawn Buller, MM, MT-BC

Sponsor of Research Study: Unfunded

VAMC: Miami / 546

Version Date of IC: 10/7/2014

PURPOSE OF STUDY AND HOW LONG IT WILL LAST:

You are being asked to take part in a research study because you are a veteran with or without post-traumatic stress disorder who has expressed an interest in music. Your participation in this research study is voluntary. The purpose of this study is to determine how veterans with PTSD recognize emotions in music. You will be asked to listen to several short music pieces and to indicate the type of emotion you hear in the music from a given list. This is a research study and should not be confused for treatment.

This medical center will involve 80 individuals. Your participation in this study will last for 45 minutes and consist of one visit to room B831, the music therapy room at this VA Medical Center.

DESCRIPTION OF THE STUDY INCLUDING PROCEDURES TO BE USED:

To begin this study, you will complete a mood scale. You will be given a list of 20 words describing how you could feel at any given time. Using a scale ranging from 1 = Very Slightly to 5 = Extremely, you will indicate how you are currently feeling for each listed word.

You will then be given the Music Emotion Rating Scale and a pencil. The researcher will read a script with instructions on how to complete the exercise. You will be instructed to listen to each musical excerpt, identify the emotion being portrayed by circling one of five listed options (happy, sad, anger, fear, tender/love), and rate the intensity of the emotion on a scale of zero (low) to ten (high). You will be given one practice item to complete before the exercise begins. Twenty-five music excerpts will be played ranging in length from 15 to 30 seconds.

Subject’s Identification (I.D. plate, or give last-name, first, middle and include complete S.S.N.)

VA Form JAN 1990 10-1086

IIR Approval: 10/20/2014

Continuing Review due by: 04/19/2015
Title of Study: Perception of Music-Emotion in Veterans with Post-Traumatic Stress Disorder
Principal Investigator: Shawn Buller, MM, MT-BC
Sponsor of Research Study: Unfunded
VAMC: Miami / 546
Version Date of IC: 10/7/2014

DESCRIPTION OF ANY PROCEDURES THAT MAY RESULT IN DISCOMFORT OR INCONVENIENCE:
Before taking part in this study, you will be asked to complete a survey with questions about your background. You do not have to answer any questions you do not want to. During the study, the music you will be listening to might trigger unpleasant emotions. You can end your participation at any time.

EXPECTED BENEFITS OF STUDY:
Anticipated Benefits to the Subject: No benefit can be promised to you from being in this study. However, possible benefits include increased pleasure, enjoyment, and relaxation as a result of the music listening task.
Anticipated Benefits to Society: This study may improve quality of treatment of veterans with PTSD through the use of music therapy. This study may also increase knowledge about human behavior.

PAYMENT FOR BEING IN THE STUDY:
You will not be paid or receive any compensation for participating in this study.

USE OF RESEARCH RESULTS:
Your name and other personal identifiable information will not be released to other parties not mentioned here unless you give us specific written permission to do so. Participant identities are kept confidential by assigning numbers to participants on questionnaires and in the database. As well, all data is reported in aggregate form. You will be told and given in writing any new information that might affect your decision to be in the study.

Records identifying you may be inspected by the study investigator and his personnel or by one or more Federal governmental agencies for regulatory purposes. In addition, the Institutional Review Board (IRB) that approved this research may have access to this informed consent document as well as to your records for auditing purposes. The purpose of these audits is to help ensure that the research is being conducted in an appropriate manner and is in the public interest. Your name and other information identifying you will be protected to the fullest extent possible. It is possible that information shared with these groups could result in a loss of your privacy although employees of these groups are obligated to protect confidentiality.

Participation and Withdrawal from the Study:
You may ask any questions you want about the study and we will try to answer them. You can refuse to be in the study or stop being in the study at any time. If you do refuse or stop, the care you are entitled to at the VA will not be affected in any way.

IRB Approval: 10/7/2014
Continuing Review due by: 04/19/2015
Title of Study: Perception of Music-Emotion in Veterans with Post-Traumatic Stress Disorder

Principal Investigator: Shawn Butler, MM, MT-BC

Sponsor of Research Study: Unfunded

VAMC: Miami / 546

If you have any questions about your rights or about medical care because of problems caused by being in the research study, you may call the Chief of Medical Administration Service or her representative at 305-575-7000, extension 3051, or you can call the Patient Advocate’s Office at (305) 575-3392. You may also call these numbers to verify that this is a valid study.

SPECIAL CIRCUMSTANCES:

Some veterans are required to pay co-payments for medical care and services provided by the VA. These co-payment requirements will continue to apply to VA provided medical care and services that are not part of this research study.

The principal investigator can take you out of the study if for any reason he feels it is in your best interest to do so or if your being in the study must be stopped for administrative reasons.

You will receive a copy of this document for your information. You may, if you want, show this document to family members, physicians or friends and ask their advice.

If you have any questions, concerns, or would like to obtain information or seek input about the study, and cannot contact the research study team or would prefer to speak with an individual who is unaffiliated with the research study, you may call the IRB office at 305-575-7000 x 4465 or the Patient Advocate’s Office at (305) 575-3392.
Title of Study: Perception of Music-Emotion in Veterans with Post-Traumatic Stress Disorder

Principal Investigator: Shawn Buller, MM, MT-BC

Sponsor of Research Study: Unfunded

VAMC: Miami / 546

Version Date of IRB: 10/7/2014

Research Subjects Rights: I have read or have had read to me all of the above. Ewan Privoznik has explained the study to me and answered all of my questions. I have been told of the risks or discomforts and possible benefits of the study. I have been told of other choices of treatment available to me.

I understand that I do not have to take part in this study, and my refusal to participate will involve no penalty or loss of rights to which I am entitled. I may withdraw from the study at any time without penalty or loss of VA or other benefits to which I am entitled.

The results of this study may be published, but my records will not be revealed unless required by law.

In case there are medical problems or questions, I have been told I can call Shawn Buller at 305-575-7000 ext. 4145. If any medical problems occur in connection with this study, the VA will provide emergency care.

I understand my rights as a research subject, and I voluntarily consent to participate in this study. I understand what the study is about and how and why it is being done. I will receive a signed copy of this consent form.

Subject's Signature or LAR (Legally Authorized Representative) Date Subject’s Name or LAR (Print)

Signature of Person Obtaining Consent Date Person Obtaining Consent (Print)

VA Form
JAN 1990 10-1086
Department of Veterans Affairs
Authorization for Use & Release of Individually Identifiable Health Information for Veterans Health Administration (VHA) Research

Subject Name (Last, First, Middle Initial): 

Subject SSN (last 4 only): 

Date of Birth: 

VA Facility (Name and Address):
Bruce W. Carter Miami VA Medical Center, 1201 NW 16th St., Miami, FL 33125

VA Principal Investigator (PI):
Shawn Buller, MM, MT-BC

PI Contact Information:
305-575-7000 ext. 4145

Study Title:
Perception of Music-Emotion in Veterans with Post-Traumatic Stress Disorder

Purpose of Study:
The purpose of this study is to determine whether adults with post-traumatic stress disorder (PTSD) perceive emotions in music differently than typically functioning adults.

USE OF YOUR INDIVIDUALLY IDENTIFIABLE HEALTH INFORMATION (IIHI):

Your individually identifiable health information is information about you that contains your health information and information that would identify you such as your name, date of birth, or other individual identifiers. VHA is asking you to allow the VA Principal Investigator (PI) and/or the VA research team members to access and use your past or present health information in addition to new health information they may collect for the study named above. The investigators of this study are committed to protecting your privacy and the confidentiality of information related to your health care.

Signing this authorization is completely voluntary. However, your authorization (permission) is necessary to participate in this study. Your treatment, payment, enrollment, or eligibility for VA benefits will not be affected, whether or not you sign this authorization.

Your individually identifiable health information used for this VA study includes the information marked below:

☐ Information from your VA Health Records such as diagnoses, progress notes, medications, lab or radiology findings, etc.

☐ Specific information concerning:
  ☐ alcohol abuse ☐ drug abuse ☐ sickle cell anemia ☐ HIV

☐ Demographic Information such as name, age, race, etc.

☐ Billing or Financial Records

☐ Photographs, Videotapes, and/or Audiotapes of you

☒ Questionnaire, Survey, and/or Subject Diary

☐ Other, as immediately described below:

APPROVED

10/26/14
Authorization for Use & Release of Individually Identifiable Health Information for
Veterans Health Administration (VHA) Research

Subject Name (Last, First, Middle Initial):  
Subject SSN (last 4 only):  
Date of Birth:

USE OF YOUR DATA OR SPECIMENS FOR OTHER RESEARCH: (This section must only be completed when banking is a required component of this study. When banking is an optional component of this study complete page 5 of this form in lieu of this section.)

☒ Not Applicable - No Data or Specimen Banking for Other Research

An important part of this research is to save your

☐ Data

☐ Specimen

in a secure repository/bank for other research studies in the future. If you do not agree to allow this use of your data and/or specimen for future studies approved by the required committees, such as the Institutional Review Board, you will not be able to participate in this study.

DISCLOSURE: The VA research team may need to disclose the information listed above to other people or institutions that are not part of VA. VA/VHA complies with the requirements of the Health Insurance Portability and Accountability Act of 1996 (HIPAA), Privacy Act of 1974 and all other applicable federal laws and regulations that protect your privacy. The VHA Notice of Privacy Practices (a separate document) provides more information on how we protect your information. If you do not have a copy of the Notice, the research team will provide one to you. Giving your permission by signing this authorization allows us to disclose your information to other institutions or persons outside the VA/VHA as noted below. Once your information has been disclosed outside VA/VHA, it may no longer be protected by federal laws and regulations and might be re-disclosed by the persons or institutions receiving the information. These non-VA/VHA institutions or persons include the entities marked below:

☐ Non-VA Institutional Review Board (IRB) at
   who will monitor the study

☐ Study Sponsor (name):
   Person or entity who takes responsibility for and initiates a clinical investigation

☒ Academic Affiliate (institution/name/employee/department): University of Miami/Teresa Lesliuk/Prof./Music Therap
   A relationship with VA in the performance of this study

☐ Compliance and Safety Monitors:
   Advises the Sponsor or PI regarding the continuing safety of this study

☐ Other Federal agencies required to monitor or oversee research (such as FDA, OHRP, GAO):

☐ A Non-Profit Corporation (name and specific purpose):

☐ Other (e.g. name of contractor and specific purpose):

[Signature]

10/20/19

10-0493  Version Date: 10-14-2014
Authorization for Use & Release of Individually Identifiable Health Information for Veterans Health Administration (VHA) Research

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**Note:** Offices within VA/VHA that are responsible for oversight of VA research such as the Office of Research Oversight (ORO), the Office of Research and Development (ORD), the VA Office of Inspector General, the VA Office of General Counsel, the VA IRB and Research and Development Committee may also have access to your information in the performance of their VA/VHA job duties.

**Access to your Individually Identifiable Health Information created or obtained in the course of this research:**
While this study is being conducted, you
☑️ will have access to your research related health records
☐ will not have access to your research related health records

This will not affect your VA healthcare including your doctor's ability to see your records as part of your normal care and will not affect your right to have access to the research records after the study is completed.

**REVOCATION:** If you sign this authorization you may change your mind and revoke or take back your permission at any time. You must do this in writing and must send your written request to the Principal Investigator for this study at the following address:

Shawn Buller  
1201 N.W. 16th St (116RT)  
Miami, FL 33125

If you revoke (take back) your permission, you will no longer be able to participate in this study but the benefits to which you are entitled will NOT be affected. If you revoke (take back) your permission, the research team may continue to use or disclose the information that it has already collected before you revoked (took back) your permission which the research team has relied upon for the research. Your written revocation is effective as soon as it is received by the study's Principal Investigator.

**EXPIRATION:** Unless you revoke (take back) your permission, your authorization to allow us to use and/or disclose your information will:

☑️ Expire at the end of this research study
☐ Expire on the following date or event:

☐ Not expire  
Expires at the end of this research study unless you have: (1) provided additional permission to store your data and/or biological specimens in a research data repository or (2) when further optional analysis of your specimens has been completed

VA FORM 10-0493  
Version Date: 10-14-2014

APPROVED  
20/20/14
| Authorization for Use & Release of Individually Identifiable Health Information for Veterans Health Administration (VHA) Research |
|---|---|---|
| Subject Name (Last, First, Middle Initial): | Subject SSN (last 4 only): | Date of Birth: |

**TO BE FILLED OUT BY THE SUBJECT**

**Research Subject Signature.** This permission (authorization) has been explained to me and I have been given the opportunity to ask questions. If I believe that my privacy rights have been compromised, I may contact the VHA facility Privacy Officer to file a verbal or written complaint.

I give my authorization (permission) for the use and disclosure of my individually identifiable health information as described in this form. I will be given a signed copy of this form for my records.

| Signature of Research Subject | Date |
| Signature of Legal Representative (if applicable) | Date |

**To Sign for Research Subject (Attach authority to sign: Health Care Power of Attorney, Legal Guardian appointment, or Next of Kin if authorized by State Law)**

| Name of Legal Representative (please print) | Date |

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**VA FORM**

**10-0493**

**Version Date: 10-14-2014**

**Page 4**

**APPROVED**

10/20/14
Authorization for Use & Release of Individually Identifiable Health Information for Veterans Health Administration (VHA) Research

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<td>VA Facility (Name and Address):</td>
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<td>Brooks W. Carter Miami VA Medical Center, 1201 NW 16th St., Miami, FL 33125</td>
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<tr>
<td>VA Principal Investigator (PI):</td>
<td>PI Contact Information:</td>
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<tr>
<td>Shawn Buller, MM, MT-BC</td>
<td>305-575-7000 ext. 4146</td>
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<tr>
<td>Study Title:</td>
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<td>Perception of Music-Emotion in Veterans with Post-Traumatic Stress Disorder</td>
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Optional Authorization Supplement for Placing My Data or My Biological Specimens in a Repository or for Conducting Optional Analysis of My Specimens For Future Use by Veterans Health Administration (VHA) Research

**Purpose.** This supplement to the authorization is for either banking of data and/or biological specimens (for example blood, urine, tissue) collected during the study for future research or for conducting optional analysis for this study. You are not required to provide this permission and not providing this permission will have no impact on your participation in this study, i.e., granting this permission is not a condition of participating in this study.

**Research Subject Signature.** This additional permission (authorization) has been explained to me and I have been given the opportunity to ask questions about this activity. By signing below, I am giving my permission for VHA to:

- [ ] Store my health information in a research data repository.
- [ ] Store my biological specimens (blood, tissue, urine, etc.) in a research data repository, or
- [ ] Further optional analysis of my specimens occurring below:

Future research of data maintained within a research data repository will only occur after further Institutional Review Board and/or other applicable approvals to ensure the protection of your individual privacy.

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<td>Name of Legal Representative (please print)</td>
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<td>To Sign for Research Subject (Attach authority to sign: Health Care Power of Attorney, Legal Guardian appointment, or Next of Kin if authorized by State law)</td>
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VA FORM 10-0493  Version Date: 10-14-2014

[Approved Stamp]